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August 13, 1957

S-CONTROL - Gallatin - Spruce Budworm

This paper is a report on the 1957 spruce budworm control program within the Gallatin National Forest and Yellowstone National Park. It is a composite of data and observations recorded by Messrs. Barrows, Driver, White, Bennett, and Ibenthal. Upon completion of the mortality checks the report was edited and completed by Mr. Driver.

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The final figure on acreage treated in the Mill Creek Unit was 113,795. The total acreage treated in Yellowstone National Park was 71,678. The attached map shows the positions of the area treated in relationship to the two forest administrative units.

The Mill Creek Unit is a large drainage embracing about four townships. It is heavily timbered with Douglas-fir and lodgepole pine. The topography breaks into three main stream channels known as the East Fork of Mill Creek, the West Fork of Mill Creek and the main channel - Mill Creek. All of the drainage is mountainous, much of it is very rugged.

The Yellowstone Park Unit is a scattering of host-type areas (Douglas-fir) which extend across the northern edge of the park. The western boundary of the sprayed area is immediately adjacent to Mammoth Hot Springs. The eastern boundary of the sprayed area is immediately adjacent to the North East Gate at Silver Gate. The western portion of the park area is moderately mountainous topography and the eastern portion is rugged mountainous topography.

The spruce budworm has been active in both units for several years. Small portions of each unit were sprayed for control of the budworm in 1955. These areas were re-infested and to round out the control units on practical boundaries during the 1957 operations, some areas were treated for the second time.

Intensity of Infestation

The intensity of infestation in the Mill Creek Unit varied from very high in the Six-Mile and River-face areas to very low in the areas adjacent to the Boulder Divide. Blocks 1, 2, 7, 8, 22, 3, 30, 12, were high to very high in intensity of infestation. Blocks 6, 9, 10, 13, 14, 16, 20, 21, and 25 were medium. Blocks 11, 15, 17 were light to medium and blocks 18, 19, 24, 26, 27, 28, and 29 were very light to lightly infested areas.

In the Yellowstone Park Unit, the intensity of infestation varied from very high in the Lower Lamar and Soda Butte areas to very low in the vicinity of North East Gate. Blocks 1, 4, 10, 11, 18, 19 and 21 varied from high to very high. Blocks 2, 3, 5, 7, 8, 9, 14, 16, 17 and 20 varied from medium to high. Blocks 12, 13, 15, 23, 24, 25, and 26 varied from low to medium and Block 22 varied from very low to low.

Damage:

Damage was extensive in both control units. One of the objectives in the 1957 program was to prevent the spread of infestation eastward. The spread has been slow but steady during past years. There was no significant stopping point due to topography or natural features. By spraying the insects this year to the limit of their advance eastward it is hoped that this advance can be stopped.

The values concerned in both control units are immense and rather hard to define on a dollar and cents basis. In Yellowstone National Park two main factors are involved. One is the scenic values because the park is very heavily used for recreational purposes and much of the infestation was within view of major highways and developed recreational centers. The second consideration in the park was the possibility of devastating fires sweeping areas killed by budworm or by secondary insect species.

Within the Mill Creek area timber and water values are of primary importance. Practically all of the water produced is used for irrigation of farms and ranches in the Yellowstone valley. A steady flow of water and a late run-off is important to the farming economy. This drainage supports a valuable stand of timber for which a market is available. Local lumbering interests are dependent upon this timber for long-time manufacturing stability. The Mill Creek drainage is also heavily used for recreational purposes.

Duration of the Project:

Insect damage surveys were made in August and September, 1956, in the Mill Creek Unit.

Insect over-winter population checks were made in the spring of 1957 in the Mill Creek Unit.

Insect development checking began on June 3, 1957 in the Mill Creek Unit.

Spraying operations were begun in the Mill Creek Unit on July 6, 1957 and completed on July 21, 1957.

Insect Damage Surveys in the Yellowstone Park Unit were begun in June 1957. Spraying operations were begun on the Yellowstone Park Unit on July 10, 1957 and completed July 21, 1957. Development checking began in the Yellowstone Park Unit on June 14, 1957.

Final mortality count checks were made in Mill Creek on July 31, 1957 and in Yellowstone Park on July 31, 1957.

Precontrol Surveys

Within the Mill Creek Unit, the control boundaries were established early in the spring of 1957. This permitted area computations and the completion of spraying plans well in advance of the date for spraying to begin.

Within Yellowstone Park there had been no ground survey work done until the snow receded late in the spring of 1957. High water in streams then further delayed complete exploration for practical exterior boundaries. Because of this the areas to be sprayed were not all finally established until the spraying of the more advanced areas had already begun. Area computations were then made and the blocking of areas for each type of plane was finished.

While this late start at precontrol work in the park had many serious disadvantages it also pointed out one desirable feature for precontrol work. This was the fact that blocking was done after the type of plane available was known. At that time a more intelligent job of blocking can be done. The size and location of blocks can then be arranged to use the plane and pilot to best advantage.

Control Methods

The control of the budworm infestation was performed by aerial spraying of DDT dissolved in fuel oil. This was applied so that one pound of DDT was used per acre. The mixture of oil and DDT was sprayed from planes calibrated for speed of flight and insecticide release and at varying heights above treetop up to 450 feet depending upon the topography being sprayed.

Aircraft Used

Various aircraft were used in the operation. The greater portion of the work was done by three converted Navy torpedo bombers known as TBM's. They deliver from 600 to 750 gallons of spray per trip. Two Stearman trainer planes converted for spraying were on the job for two days. One larger plane, a C-82 packet, was used to deliver insecticide to the longer haul areas. This plane had a capacity of two thousand gallons of insecticide. Two tri-motor Ford planes (capacity 450 gallons) were used on the Gardiner Air Strip for park spraying. Three small planes (two Cessna 180's and one Beechcraft Bonanza) were used as scout and observation planes. All of the aircraft used were entirely suited for the job. The two Stearmans (125-gallon capacity) did not stay after the first day's work because the length of haul made it an unprofitable operation for them.

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Organization

The Forest Service organization on the spray job is shown on the plan and instructions attached in the appendix of this report. The Livingston air strip required the use of a night watchman and two maintenance men who worked a regular daytime shift. In addition to the field maintenance done by these men a water truck was employed to sprinkle the runway after each days flying.

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The biological crew in each unit was entirely untrained in this work. These men were students and smokejumpers who readily picked up the ideas and methods. These men were all physically able to perform the long hikes required because of a lack of roads. Due to slow foot travel the work of the biology crews was particularly difficult at the beginning of spraying when development plot work plus laying out cards had to be done at the same time.

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There was no noted difficulty between the crews of the various organizations on the project. There was a need for closer correlation between the biology crews' and their findings and the spraying crews. This was due to the distance between the work centers. The biology crew was based at Chico for the Mill Creek Unit and Camp Roosevelt for the Park Unit. The spraying was done from airstrips at Livingston and Gardiner. Phone service was maintained between these points but complete coordination was still lacking. If at all possible, it is better to base both biology and spraying personnel at the same camp or town.

Transportation for the biology crews and others was by worn out Forest Service automotive equipment or by personal car. Transportation was inadequate and unsatisfactory. It is recommended that on future jobs satisfactory automotive equipment be purchased or rented just as we do on any of our other regular work jobs.

Communication

Telephone and radio provided communication on the project. This is a vital necessity. There were no communication failures and only rarely were we unable to contact interested parties by radio. The V.H.F. radios loaned to the project by Fire Control were an important link in the communication set up.

Communication Net

The Communication Net used on the combined Mill Creek - Yellowstone Park Control Unit proved to be adequate to give the supervisory personnel the control necessary to accomplish the spray job without undue delay or complications.

The net was an integrated system of telephone, S.P.F., and high frequency radio.

Commercial telephones were put in at Mission Air Field (headquarters for the Mill Creek spraying unit), Chico Lodge (headquarters for the Mill Creek Biological unit), Roosevelt Lodge (headquarters for the Park Biological unit). This system proved adequate as these units were connected with all commercial telephone facilities.

The telephone at the Gardiner district office in Gardiner was used for the communications for the Gardiner Air Field.

An S.P.F. net with radios at Mission Field, Gardiner Airport, Mt. Washburn, and two mobile units for Mill Creek was set up. This net tied into the Gardiner district M set, which was used as a relay station to relay any message not readily transmitted between any two S.P.F. sets. This relay point also tied the S.P.F. and high frequency net into the commercial telephone services.

High frequency sets were placed in two observation planes, the Gardiner Air Port, Mission Air Field and Mt. Washburn.

The observation plane used in Mill Creek could contact Mission Field by this high frequency radio. The observation plane used in the park could contact the Gardiner air strip by transmitting his call on high frequency radio to Mt. Washburn. Mt. Washburn relayed to air strip on SPF. Frequently, Gardiner district would have to relay this message. However, nearly always the message would be received. The contact between Mt. Washburn and the observation plane failed three days before the job ended. Checking and battery changing did not restore contact.

Overall, the communication net worked very well and was quite satisfactory.

We recommend that the communication net be shown on a net map and be posted where all employees have ready access for reference. A directory of phone numbers, call numbers, and operator names is a desirable part of this map.

The observation plane used in the park had inter-comm contact with the C-82 plane used to spray the park blocks. This proved to be most advantageous. We recommend the Forest Service explore the possibility of future contracts having all two-pilot planes equipped with this radio system. The Forest Service could then install crystals in their V.H.F. radios to provide contact with these spray planes. This provides an opportunity for the observer to correct mistakes and make advantageous changes while the plane is in the air.

We assume that in planes operated by only one pilot, the radio would be a hazard to the safety of the pilot by inducing a possibility of diverting his attention from his immediate job of flying.

Maps, records and form material were entirely adequate on the project.

Private Forest Land Cooperation

There are nine private landowners involved in the Mill Creek Unit. Of these, three owners paid or agreed to pay before December 31, 1957. Their land totaled 370 acres. Three landowners refused to pay on their land because of finances and not because of any quarrel with the project. The acreage involved is 737 acres. Three landowners are nonresident and this was turned over to the State Forester for contact and collection. The acreage involved is 580 acres. Total private land acreage involved is 1,687 acres.

The costs involved in collection on these private lands were very high. The assistant ranger on the Yellowstone District accompanied the State Forester's representative to contact these private landowners. It was necessary to make two or three trips before some of these owners could be contacted. Exact costs are unknown.

To reduce costs, it is suggested that first contact be made by a group meeting at which the project will be discussed and the costs involved could be explained. Then when the project is reasonably definite, each owner could be contacted by mail requesting that he get in touch with the local forest officer or State Forester's representative within a specified time similar to the time specified for grazing permits. At such time, the private owner could sign the agreement, or refuse payment according to his own desires.

Contractors Ground Organization

The contractor sub-lets portions of the contract to independent plane owners. This has the effect of throwing too much supervision on the contracting officer. From the wordings of the bid, the contracting officer should have responsibility of inspection only. We go much beyond this in providing recordkeeping and facilities for expediting the job. The question is whether we would get a better, cheaper over-all job if we stuck to inspection or whether the other services we provide actually result in a more satisfactory over-all job.

A safety program was devised for this particular job and is attached to the appendix of the report. Everyone subscribed thoroughly to it and there were no accidents either major or minor. To my knowledge there were no near misses. It must be recognized, however, that spraying is extremely hazardous work and accidents are probable. The objective of the safety program was to reduce the chances of accident to a minimum.

Forest Service Field Layout

This setup left much to be desired in appearance and comfort but it did function well. The office and record room was a separate structure from the pilots briefing, loafing and mapping room. Each layout on every strip must vary with the room available and the amount of work to be done. It would be impractical to try to standardize a layout for either the contractor or the contracting officer.

Studies

A special study within Yellowstone National Park was carried out on aquatic insects and fish during the spraying operation. This work was done by the Fish and Wildlife Service and the results or conclusions are not known at this time.

Delineation of Spray Blocks

Altitudinal limits and small spray blocks are not conducive to good final results. These restrictions may be necessary if the number of aircraft are severely limited. Ordinarily, time can be used to better advantage if large blocks are opened to spraying at one time and if the height of spraying can be 400 feet or more above treetops a more complete job can be done by using large block areas.

Roads, ridges and creeks make the most practical block boundaries.

Biological Aspects of Program in Relation to Administrative Program

1. Prespray insect development checking.

    (a) Insect development checking was started on June 3, 1957 in the Mill Creek area, and on June 14, 1957, in the Yellowstone Park Unit. There were a total of 27 plots established in the Mill Creek Unit and 21 plots in the Yellowstone Park Unit.

    (b) Geographical location of all insect development plots is shown on attached $\frac{1}{2}$" maps of Mill Creek and Yellowstone Park Unit. Also attached are completed Forms 19, Development Plot Data.

    (c) The elevational and aspects groups of the development plots is as shown below. It is recommended that a space be provided on Form 19 for posting the elevation.

ELEVATIONS

Mill Creek Unit

5500 - 6000	6100 - 6500	6600 - 7000	7100 - Plus
402	401	403	412
404	405	407	415
416	406	408	421
	417	409	422
	419	410	
	427	411	
		413	
		414	
		418	
		420	
		424	
		425	
		426	

Yellowstone Park

	803	801	804
	810	802	807
	816	805	811
	817	806	812
	818	808	813
	821	809	815
		814	819
		822	820

ASPECTS

Mill Creek Unit

North	South	East	West
403	401	408	402
406	404		405
409	411		407
412	414		410
426	415		413
	420		416
	421		417
	422		418
			419
			423
			424
			425

Yellowstone Unit

North	South	East	West
801	805	807	804
803	808	821	
806	813		
802	818		
809	820		
810			
811			
812			
814			
815			
816			
817			
819			
822			

Technical Reports to Administrative Reports Organization

The ten-day notice was given on the Mill Creek Unit on June 26, 1957. First block release was on July 4, 1957. First spraying was on July 6, 1957.

The ten-day notice was given on the Yellowstone Park Unit on July 2, 1957. First block release was on July 8, 1957. First spraying was on July 10, 1957.

It is thought best to use the guideline of 50% for the 4th, 5th and 6th instar for giving the advance notice. Also, that 50% in the 5th and 6th instar should be used as a guideline in releasing blocks for spraying. This will give the unit supervisor a better chance to organize his organization for handling these blocks. It is not unusual that blocks will not be sprayed for two or three days after they are released. If this guideline were used, the budworm would probably be 60-65% in the 5th and 6th before actually being sprayed anyway.

It is recommended that a chart be printed to record the information as recorded on Chart No. "X" in the appendix. This form, when completed, is a very helpful aid in predicting developments, and thus laying out the work for the pilots, etc.

Delineation of Spray Blocks

Where practical, 1000 feet altitude limitations are very good. However, it is found that unless a practical boundary which can be seen from the air, such as road, stream, or ridge, coincides with the elevational boundary, then elevational boundaries are not good. It will be necessary to spray the lower elevations in the block as per schedule, then spray the upper portions at a later date when the development has proceeded to the desired point.

Aspect limitations are practical generally because development is affected somewhat by aspect.

The principal factor in development is elevation. Major aspect changes affect development. Development at the same elevation on the northern aspects was delayed one or two days behind the southern aspects. Where practical, blocks should be limited to the same aspect.

Acre-size limitations are not generally good because the ground has to be laid out to accommodate the type of aircraft on the job.

Delineation of Interior Spray Areas

In general, the interior delineations on both the Mill Creek and Yellowstone Units worked out very well.

1. The minimum size and shape of the interior non-spray areas should be adjusted so that shape and size will be practical. Out areas should be either circular or more or less square or rectangular. Minimum width should be at least ½ mile. Long, thin, stringers should be avoided unless small planes will be used.

2. Delineating between host type and non-host type without the benefit of topographic features is next to impossible. Pilots cannot differentiate between Douglas-fir and lodgepole pine unless there is a large area of young lodgepole pine, or unless it is marked by good topographic features.

The biological organization functioned very well and it collected the data needed for the administrative organization. If at all possible, it is recommended that the biological headquarters be located with the administrative headquarters. This would increase the coordination between the two organizations and help the biologist and unit supervisor to better understand each other's problems. Good, reliable, transportation and communication facilities are a must.

Mortality

Mortality checks were made on 22 blocks out of 30 in the Mill Creek Unit with a percentage mortality ranging from 70% in Block No. 26 to 100% in Blocks 9, 11, 17, 18, 19, 24, 28, and 29, with an average of 96%.

Mortality checks were made in nine blocks in the Yellowstone Park Unit. Average mortality was 79%. However, it is recommended that blocks 3 and 11 be eliminated when figuring mortality. In Block No. 3, the spray deposit was very low on the card line but was found to be adequate elsewhere in the block when a ground check was made. In Block No. 11, the mortality and card line was located too close to Slough Creek and since it was not desirable to spray the creek, the card line showed very low deposit. Ground check showed that the balance of the block was treated adequately. It is believed that these checks in Block Nos. 3 and 11 are not reliable due to conditions outlined above. With the elimination of these two blocks the average mortality for the Park Unit would be 86%.

Also, another item should be considered in judging the success of the Park Unit and that is the accelerated development which took place. In comparing the development in the Mill Creek and Park Units, it will be noted that development proceeded at a normal rate in the Mill Creek Unit whereas development was greatly accelerated in the Park Unit during the latter part of the development period.

Another item which should be considered well in advance of another control program is sufficient supply of forms for recording biological information. Some forms were not adequately supplied this year (Forms 17 and 18) even after repeated requests.

Attachments

Item No. 1 -- Completed SBW - Form 19 for Mill Creek Unit
Item No. 2 -- Completed SBW - Form 19 for Yellowstone Park Unit
Item No. 3 -- Chart "X" for Mill Creek Unit
Item No. 4 -- Chart "X" for Yellowstone Park
Item No. 5 -- Organization Chart
Item No. 6 -- Progress Chart - Mill Creek Unit
Item No. 7 -- Progress Chart - Yellowstone Park Unit
Item No. 8 -- ½" Map showing unit boundary, block boundary, location of development plots - Mill Creek Unit (In duplicate)
Item No. 9 -- ½" Map showing unit boundary, block boundary, and location of development plots - Yellowstone Park Unit (In duplicate)

only on the a copy

cc: Yellowstone National Park
2c: Regional Office

WHI/tp

Tmbr. Mgmt.

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TIMBER
MANAGEMENT

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The Communication Net used on the combined Mill Creek - Yellowstone Park Control unit proved to be adequate to give the supervisory personnel the control necessary to accomplish the spray job without undue delay or complications.

The net was an integrated system of telephone, S.P.F., and high frequency radio.

Commercial telephones were put in at Mission Air Field (headquarters for the Mill Creek spraying unit), Chico Lodge (headquarters for the Mill Creek Biological unit), Roosevelt Lodge (headquarters for the Park Biological unit). This system proved adequate as these units were connected with all commercial telephone facilities.

The telephone at the Gardiner district office in Gardiner was used for the communications for the Gardiner Air Field.

An S.P.F. net with radios at Mission Field, Gardiner Airport, Mt. Washburn, and two mobile units for Mill Creek was set up. This net tied into the Gardiner district M set, which was used as a relay station to relay any message not readily transmitted between any two S.P.F. sets. This relay point also tied the S.P.F. and high frequency net into the commercial telephone services.

High frequency sets were placed in two observation planes, the Gardiner Air Port, Mission Air Field and Mt. Washburn.

The observation plane used in Mill Creek could contact Mission Field by this high frequency radio. The observation plane used in the park could contact the

the Gardiner air strip by transmitting his call on high frequency radio to Mt. Washburn. Mt. Washburn relayed to air strip on SPF. Frequently, Gardiner district would have to relay this message. However, nearly always the message would be received. The contact between Mt. Washburn and the observation plane failed three days before the job ended. Checking and battery changing did not restore contact.

Over-all, the communication net worked very well and was quite satisfactory.

We recommend that the communication net be shown on a net map and be posted where all employees have ready access for reference. A directory of phone numbers, call numbers, and operator names is a desirable part of this map.

The observation plane used in the park had inter-comm contact with the C-82 plane used to spray the park blocks. This proved to be most advantageous. We recommend the Forest Service explore the possibility of future contracts having all two-pilot planes equipped with this radio system. The Forest Service could then install crystals in their V.H.F. radios to provide contact with these spray planes. This provides an opportunity for the observer to correct mistakes and make advantageous changes while the plane is in the air.

We assume that in planes operated by only one pilot, the radio would be a hazard to the safety of the pilot by inducing a possibility of diverting his attention from his immediate job of flying.

Maps, records and form material were entirely adequate on the project.

Private Forest Land Cooperation

There are nine private landowners involved in the Mill Creek Unit. Of these, three owners paid or agreed to pay before December 31, 1957. Their land totaled 370 acres. Three land-owners refused to pay on their land because of finances and not because of any quarrel with the project. The acreage involved is 737 acres. Three land-owners are non-resident and this was turned over to the State Forester for contact and collection. The acreage involved is 580 acres. Total private land acreage involved is 1,687 acres.

The costs involved in collection on these private lands were very high. The assistant ranger on the Yellowstone District accompanied the State Forester's representative to contact these private land-owners. It was necessary to make two or three trips before some of these owners could be contacted. Exact costs are unknown.

To reduce costs, it is suggested that first contact be made by a group meeting at which the project will be discussed and the costs involved could be explained. Then when the project is reasonably definite, each owner could be contacted by mail requesting that he get in touch with the local forest officer or State

Forester's representative within a specified time similar to the time specified for grazing permits. At such time, the private owner could sign the agreement, or refuse payment according to his own desires.

Contractors Ground Organization

The contractor sub-lets portions of the contract to independent plane owners. This has the effect of throwing too much supervision on the contracting officer. From the wordings of the bid, the contracting officer should have responsibility of inspection only. We go much beyond this in providing record keeping and facilities for expediting the job. The question is whether we would get a better, cheaper over-all job if we stuck to inspection or whether the other services we provide actually result in a more satisfactory over-all job.

A safety program was devised for this particular job and is attached to the appendix of the report. Everyone subscribed thoroughly to it and there were no accidents either major or minor. To my knowledge there were no near misses. It must be recognized, however, that spraying is extremely hazardous work and accidents are probable. The objective of the safety program was to reduce the chances of accident to a minimum.

Forest Service Field Layout

This set up left much to be desired in appearance and comfort but it did function well. The office and record room was a separate structure from the pilots briefing, loafing and mapping room. Each layout on every strip must vary with the room available and the amount of work to be done. It would be impractical to try to standardize a layout for either the contractor or the contracting officer.

Studies

A special study within Yellowstone National Park was carried out on aquatic insects and fish during the spraying operation. This work was done by the Fish and Wildlife Service and the results or conclusions are not known at this time.

Delineation of Spray Blocks

Altitudinal limits and small spray blocks are not conduc~~t~~ive to good final results. These restrictions may be necessary if the number of aircraft are severely limited. Ordinarily, time can be used to better advantage if large blocks are opened to spraying at one time and if the height of spraying can be 400 feet or more above tree tops a more complete job can be done by using large block areas.

Roads, ridges and creeks make the most practical block boundaries.

Biological Aspects of Program in Relation to Administrative Program

1. Prespray insect development checking.

   (a) Insect development checking was started on June 3, 1957 in the Mill Creek area, and on June 14, 1957, in the Yellowstone Park Unit. There were a total of 27 plots established in the Mill Creek Unit and 21 plots in the Yellowstone Park Unit.

   (b) Geographical location of all insect development plots is shown on attached ½" maps of Mill Creek and Yellowstone Park Unit. Also attached are completed Forms 19, Development Plot Data.

   (c) The elevational and aspects groups of the development plots is as shown below. It is recommended that a space be provided on Form 19 for posting the elevation.

ELEVATIONS

Mill Creek Unit

5500 - 6000	6100 - 6500	6600 - 7000	7100 - Plus
402	401	403	412
404	405	407	415
416	406	408	421
	417	409	422
	419	410	
	427	411	
		413	
		414	
		418	
		420	
		424	
		425	
		426	

Yellowstone Park

5500 - 6000	6100 - 6500	6600 - 7000	7100 - Plus
	803	801	804
	810	802	807
	816	805	811
	817	806	812
	818	808	813
	821	809	815
		814	819
		822	820

ASPECTS

Mill Creek Unit

North	South	East	West
403	401	408	402
406	404		405
409	411		407
412	414		410
426	415		413
	420		416
	421		417
	422		418
			419
			423
			424
			425

Yellowstone Unit

North	South	East	West
801	805	807	804
803	808	821	
806	813		
802	818		
809	820		
810			
811			
812			
814			
815			
816			
817			
819			
822			

Technical Reports to Administrative Reports Organization

The ten-day notice was given on the Mill Creek Unit on June 26, 1957. First block release was on July 4, 1957. First spraying was on July 6, 1957.

The ten-day notice was given on the Yellowstone Park Unit on July 2, 1957. First block release was on July 8, 1957. First spraying was on July 10, 1957.

It is thought best to use the guideline of 50% for the 4th, 5th and 6th instar for giving the advance notice. Also, that 50% in the 5th and 6th instar should be used as a guideline in releasing blocks for spraying. This will give the unit supervisor a better chance to organize his organization for handling these blocks. It is not unusual that blocks will not be sprayed for two or three days after they are released. If this guideline were used, the budworm would probably be 60-65% in the 5th and 6th before actually being sprayed anyway.

It is recommended that a chart be printed to record the information as recorded on Chart No. "X" in the appendix. This form, when completed, is a very helpful aid in predicting developments, and thus laying out the work for the pilots, etc.

Delineation of Spray Blocks

Where practical, 1000 feet altitude limitations are very good. However, it is found that unless a practical boundary which can be seen from the air, such as road, stream, or ridge, coincides with the elevational boundary, then elevational boundaries are not good. It will be necessary to spray the lower elevations in the block as per schedule, then spray the upper portions at a later date when the development has proceeded to the desired point.

Aspect limitations are practical generally because development is affected somewhat by aspect.

The principal factor in development is elevation. Major aspect changes affect development. Development at the same elevation on the northern aspects was delayed one or two days behind the southern aspects. Where practical, blocks should be limited to the same aspect.

Acre-size limitations are not generally good because the ground has to be laid out to accommodate the type of aircraft on the job.

Delineation of Interior Spray Areas

In general, the interior delineations on both the Mill Creek and Yellowstone Units worked out very well.

1. The minimum size and shape of the interior non-spray areas should be adjusted so that shape and size will be practical. Out areas should be either circular or more or less square or rectangular. Minimum width should be at least ½ mile. Long, thin, stringers should be avoided unless small planes will be used.

2. Delineating between host type and non-host type without the benefit of topographic features is next to impossible. Pilots cannot differentiate between Douglas fir and Lodgepole Pine unless there is a large area of young Lodgepole Pine, or unless it is marked by good topographic features.

The biological organization functioned very well and it collected the data needed for the administrative organization. If at all possible, it is recommended that the biological headquarters be located with the administrative headquarters. This would increase the coordination between the two organizations and help the biologist and unit supervisor to better understand each other's problems. Good, reliable, transportation and communication facilities are a must.

Mortality

Mortality checks were made on 22 blocks out of 30 in the Mill Creek Unit with a percentage mortality ranging from 70% in Block No. 26 to 100% in Blocks 9, 11, 17, 18, 19, 24, 28, and 29, with an average of 96%.

Mortality checks were made in nine blocks in the Yellowstone Park Unit. Average mortality was 79%. However, it is recommended that blocks 3 and 11 be eliminated when figuring mortality. In Block No. 3, the spray deposit was very low on the card line but was found to be adequate elsewhere in the block when a ground check was made. In Block No. 11, the mortality and card line was located too close to Slough Creek and since it was not desirable to spray the creek, the card line showed very low deposit. Ground check showed that the balance of the block was treated adequately. It is believed that these checks in Block Nos. 3 and 11 are not reliable due to conditions outlined above. With the elimination of these two blocks the average mortality for the Park Unit would be 86%.

Also, another item should be considered in judging the success of the Park Unit and that is the accelerated development which took place. In comparing the development in the Mill Creek and Park Units, it will be noted that development proceeded at a normal rate in the Mill Creek Unit whereas development was greatly accelerated in the Park unit during the latter part of the development period.

Another item which should be considered well in advance of another control program is sufficient supply of forms for recording biological information. Some forms were not adequately supplied this year (Forms 17 and 18) even after repeated requests.

Attachments

Item No. 1 -- Completed SBW - Form 19 for Mill Creek Unit
Item No. 2 -- Completed SBW - Form 19 for Yellowstone Park Unit
Item No. 3 -- Chart "X" for Mill Creek Unit
Item No. 4 -- Chart "X" for Yellowstone Park
Item No. 5 -- Organization Chart

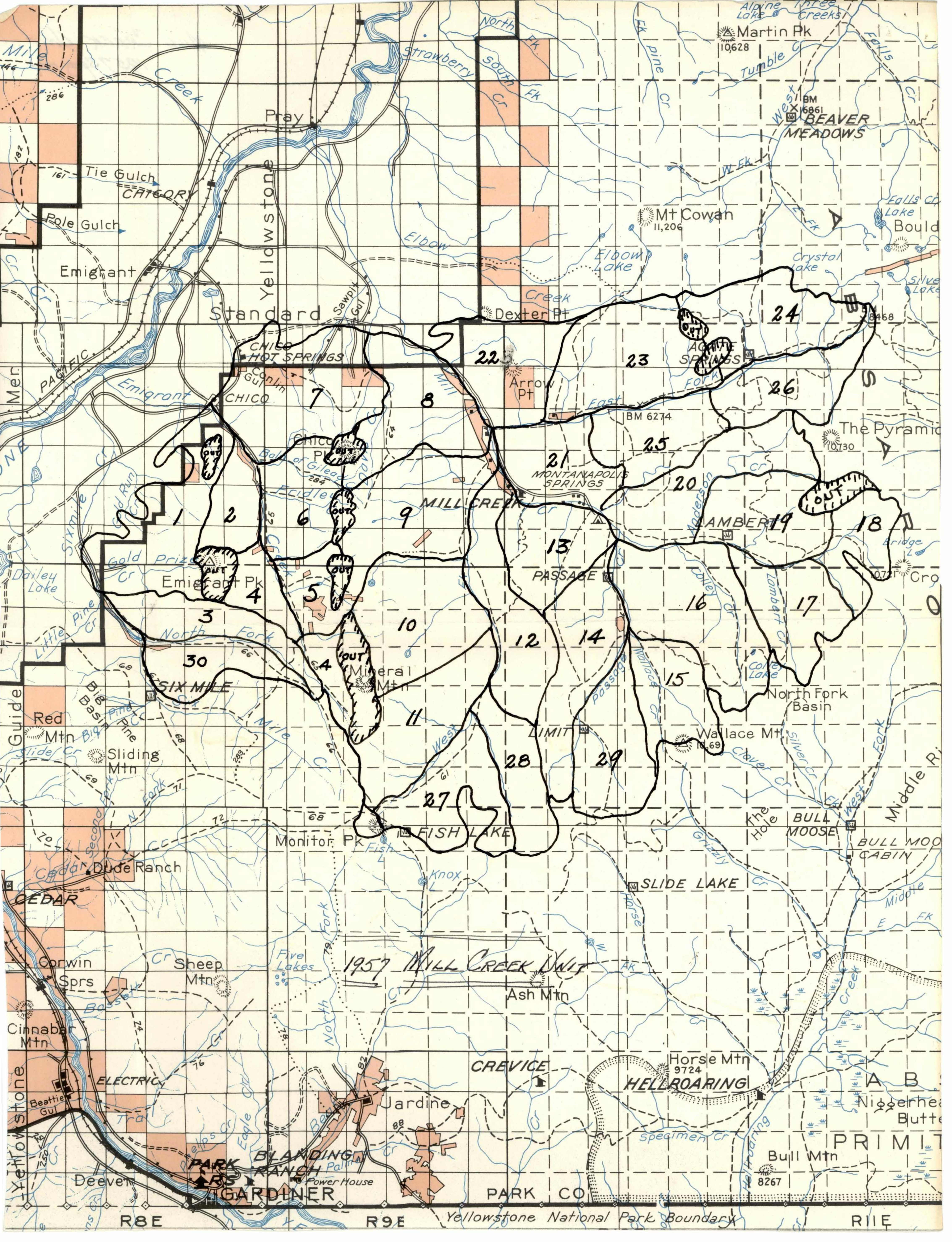
Attachments (Continued)

Under Separate Cover

Item No. 6 — Progress Chart - Mill Creek Unit
Item No. 7 — Progress Chart - Yellowstone Park Unit
Item No. 8 — ½" Map showing unit boundary, block boundary, location of development plots - Mill Creek Unit (In duplicate)
Item No. 9 — ½" Map showing unit boundary, block boundary, and location of development plots - Yellowstone Park Unit (In duplicate)

cc: Yellowstone National Park
✓ 2c: Regional Office

WILLIAM H. IBENTHAL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Pole Gulch
Emigrant
Yellowstone
Standard
Sawpit Gul
PACIFIC
CHICO HOT SPRINGS
Conlin Gul
CHICO
Emigrant
Strawberry
North Fk
South Fk
Cr
Elbow
Creek
Dexter Pt
Arrow Pt
Mill
Fk Pine Cr
Alpine Lake
Three Creeks
Martin Pk
10628
Tumble Cr
Falls Cr
West
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BEAVER MEADOWS
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Bould
Crystal Lake
Silver Lake
Elbow Lake
AGATE SPRINGS
East Fork
BM 6274
The Pyramid
10,730
MONTANAPOLIS SPRINGS
MILL CREEK
LAMBERT
Bridge
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Cro
Chico Pk
Balm of Gilead
Fridley
Sixmile Cr
Gold Run
Gold Prize Cr
Emigrant Pk
Dailey Lake
Little Pine Cr
North Fork
SIX MILE
Mineral Mtn
West
PASSAGE
Anderson
Cr
Lombard Cr
Coley Cr
Passage
Wallace Cr
Cole Lake
North Fork Basin
Wallace Mt
LIMIT
Silver Cr
Clover Cr
West Fk
Middle
Guide Mer
Red Mtn
Big Basin
Big Pine
Slide Cr
Sliding Mtn
N Fork
Second
Cedar
Dude Ranch
CEDAR
Monitor Pk
FISH LAKE
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Knox L
Grizzly
The Hole
BULL MOOSE
BULL MOOSE CABIN
SLIDE LAKE
Horse
Five Lakes
North Fork Cr
North Cr
Corwin Sprs
Sheep Mtn
Bassett
Ash Mtn
Cinnabar Mtn
ELECTRIC
Trail
Beattie Gul
Yellowstone
Jardine
Bear
CREVICE
Horse Mtn 9724
HELLROARING
Niggerhead Butte
PRIMIT
Specimen Cr
Bull Mtn 8267
Hellroaring
Eagle Cr
Phelps Cr
Palmer Cr
BLANDING RANCH
PARK R S
Power House
Deever
GARDINER
PARK CO
R8E
R9E
Yellowstone National Park Boundary
R11E
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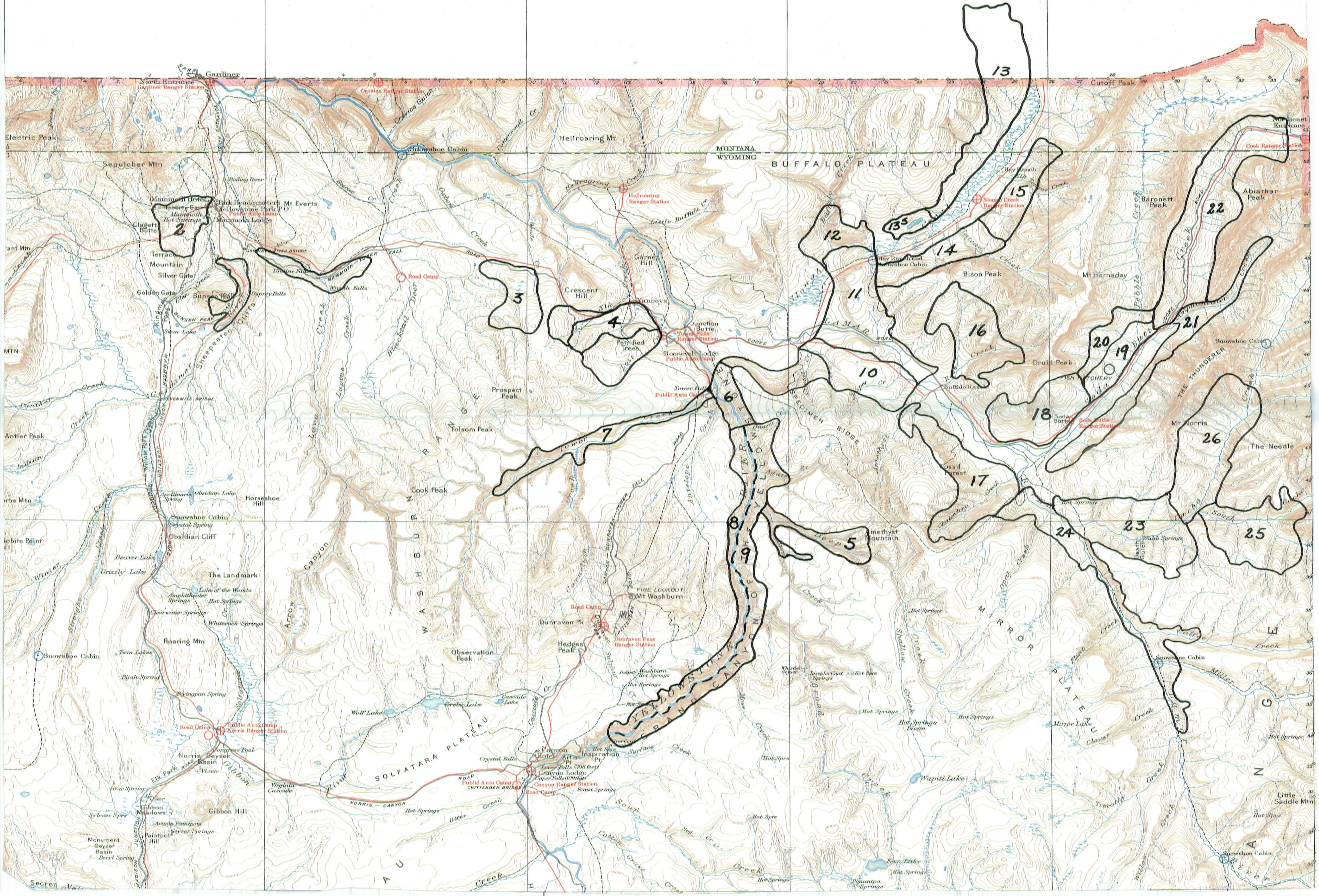
OUT

1957 Mill Creek Unit

YELLOWSTONE UNIT
1957 spray map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MONTANA
WYOMING
BUFFALO PLATEAU
Gardiner
North Entrance
Gardiner Ranger Station
Cutoff Peak
Northeast Entrance
Cook Ranger Station
Electric Peak
Sepulcher Mtn
Hellroaring Mt.
Snowshoe Cabin
Mammoth Hotel
Mammoth Hot Springs
Mammoth Lodge
Park Headquarters Mt Everts
Clagett Butte
Terrace Mountain
Silver Gate
Golden Gate
Bunsen Peak
Sheepeater Cliffs
Swan Lake
Road Camp
Crescent Hill
Garnet Hill
Yanceys
Junction Butte
Tower Falls Ranger Station
Petrified Trees
Roosevelt Lodge
Public Auto Camp
Tower Falls
Prospect Peak
Folsom Peak
Cook Peak
WASHBURN RANGE
Hay Ranch and Snowshoe Cabin
Slough Creek Ranger Station
Bison Peak
Mt Hornaday
Baronett Peak
Abiathar Peak
LAMAR
Druid Peak
FISH HATCHERY
Buffalo Ranch
SPECIMEN RIDGE
Soda Butte
Soda Butte Ranger Station
THE THUNDERER
Mt Norris
The Needle
Fossil Forest
Amethyst Mountain
MIRROR PLATEAU
GRAND CANYON OF THE YELLOWSTONE
YELLOWSTONE RIVER
Mt Washburn
FIRE LOOKOUT
Dunraven Pk
Dunraven Pass Ranger Station
Hedges Peak
Observation Peak
Antler Peak
Obsidian Cliff
Beaver Lake
Grizzly Lake
The Landmark
Roaring Mtn
Twin Lakes
Norris Geyser Basin
Norris Ranger Station
SOLFATARA PLATEAU
Canyon Hotel
Canyon Lodge
Canyon Ranger Station
Inspiration Pt
Wapiti Lake
Mirror Lake
Little Saddle Mtn
Gibbon Hill
Gibbon Meadows
Monument Geyser Basin
Paintpot Hill